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			ART UNIT	PAPER NUMBER
			2684	

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/608,544

Applicant(s)

PARAMESH ET AL.

Examiner

Dominic E. Rego

Art Unit

2684

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>11/26/03, 11/16/04</u> .  | 6) <input type="checkbox"/> Other: _____                                    |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1,2,5,6,11,12,17,18,22, and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Aoyama (*US Patent Application Publication #20020158800*).

**Regarding claim 1**, Aoyama teaches an apparatus comprising:

an antenna weighted value (weight factor) generator to provide an antenna weighted value to a received signal by a manipulation of a first value derived from an amplitude of the received signal and a second value derived from a phase of the received signal (Page 1, 0003 and 0004: Aoyama teaches the array antenna radio communication apparatus is a radio communication apparatus which is provided with a plurality of antennas, and may freely set directivity by adjusting each amplitude and phase of signals received at each antenna. The array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")).

**Regarding claim 2**, Aoyama teaches the apparatus, wherein the antenna

weighted value generator comprises: a first variable amplifier to adjust an amplitude of the received signal; and a second variable amplifier operably coupled to the first amplifier to adjust the phase of the amplitude adjusted receive signal (Page 1,

0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight"). The array antenna radio communication apparatus may intensely receive only signals incoming from a desired direction by adjusting the multiplying weight).

**Regarding claim 5, Aoyama teaches an apparatus comprising:**

two or more antenna (See Figure 1, elements 101-1, 101-2, and 101-3) weighted value (weight factor) generators to provide antenna weighted values to two or more signals received at two or more antennas, respectively, wherein at least one of said antenna weighted value generators is able to generate a first antenna weighted value based on a manipulation of a first value derived from an amplitude of the two or more received signals and a second antenna weighted value derived from a phase of the two or more received signals (Page 1, 0003 and 0004: Aoyama teaches the array antenna radio communication apparatus is a radio communication apparatus which is provided with a plurality of antennas, and may freely set directivity by adjusting each amplitude and phase of signals received at each antenna. The array antenna radio communication apparatus adjusts the amplitude and phase of the

received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")).

**Regarding claim 6**, Aoyama teaches the apparatus, wherein the antenna weighted value generator comprises:

a first variable amplifier to adjust an amplitude of the received signal and to provide an amplitude adjusted signal; and a second variable amplifier operably coupled to the first variable amplifier to adjust the phase of the amplitude adjusted signal (Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight"). The array antenna radio communication apparatus may intensely receive only signals incoming from a desired direction by adjusting the multiplying weight).

**Regarding claim 11**, Aoyama teaches an apparatus comprising:

two or more dipole antennas to receive two or more signals (Figure 1, elements 101-1, 101-2 and 101-3 are dipole antennas to receive two or more signals); and

two or more antenna weighted value (weight factor) generators to provide antenna weighted values to the two or more signals received at two or more antennas, respectively, wherein at least one of said antenna weighted value generators is able to generate a first antenna weighted value based on a manipulation of a first value derived

Art Unit: 2684

from an amplitude of the two or more received signals and a second antenna weighted value derived from a phase of the two or more received signals (Page 1, 0003 and 0004: Aoyama teaches the array antenna radio communication apparatus is a radio communication apparatus which is provided with a plurality of antennas, and may freely set directivity by adjusting each amplitude and phase of signals received at each antenna. The array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")).

**Regarding claim 12,** Aoyama teaches the apparatus, wherein the antenna weighted value generator comprises: a first variable amplifier to adjust an amplitude of the received signal and to provide an amplitude adjusted signal; and a second variable amplifier operably coupled to the first variable amplifier to adjust the phase of the amplitude adjusted signal (Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight"). The array antenna radio communication apparatus may intensely receive only signals incoming from a desired direction by adjusting the multiplying weight).

**Regarding claim 17,** Aoyama teaches a communication system comprising: a first communication device to transmit plurality of signals over plurality of channels ; a

second communication device to receive the plurality of signals by plurality of antennas and to combine the plurality of signals by providing antenna weighted values to the signals (Col. 1, 0010: Aoyama teaches an object of the present invention is to provide an array antenna radio communication apparatus and an array antenna radio communication method, capable of improving a reception quality by setting values of the reception weights for a plurality of signals transmitted from the same direction on a plurality of channels to the same value).

**Regarding claim 18,** Aoyama teaches the communication system, wherein the second communication device comprises:

an antenna receiver comprises plurality of antenna (Figure 1, elements 101-1, 101-2 and 101-3) weighted value (weight factor) generators operably coupled to the plurality of antennas wherein, an antenna weighted value generator of the plurality of the antenna weighted value generators is able to provide an antenna weighted value to the plurality signals based on a manipulation of a first value derived from an amplitude of a received signal received by an antenna of the plurality of antennas and a second value derived from a phase of the received signal (Page 1, 0003 and 0004: Aoyama teaches the array antenna radio communication apparatus is a radio communication apparatus which is provided with a plurality of antennas, and may freely set directivity by adjusting each amplitude and phase of signals received at each antenna. The array antenna radio communication apparatus adjusts the amplitude and

phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")).

**Regarding claim 22,** Aoyama teaches a method comprising: weighting plurality of signals by adjusting an amplitude and a phase of the plurality of signals based on a channel estimated information; and combining the plurality of weighted signals to provide a radio frequency signal (Page 1, 0003 and 0004: Aoyama teaches the array antenna radio communication apparatus is a radio communication apparatus which is provided with a plurality of antennas, and may freely set directivity by adjusting each amplitude and phase of signals received at each antenna. The array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")).

**Regarding claim 23,** Aoyama teaches the method further comprising: transmitting the signals over plurality of channels; and receiving the signals by plurality of antennas (Col. 1, 0010: Aoyama teaches an object of the present invention is to provide an array antenna radio communication apparatus and an array antenna radio communication method, capable of improving a reception quality by setting values of the reception weights for a plurality of signals transmitted from the same direction on a plurality of channels to the same value).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 3,4,7-10,13-16,19-21, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama (*US Patent Application Publication #20020158800*) in view of Koga et al. (*US Patent #6,577,686*).

**Regarding claim 3**, Aoyama teaches all the claimed elements in claim 2, except for the apparatus, wherein the second variable amplifier is able to provide a real portion of the phase of the antenna weighted value and an imaginary portion of the phase of the antenna weighted value.

However, in related art, Koga teaches the apparatus, wherein the second variable amplifier is able to provide a real portion of the phase of the antenna weighted value and an imaginary portion of the phase of the antenna weighted value (Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the apparatus, wherein the second variable amplifier is able to provide a real portion of the phase of the antenna weighted value and an imaginary portion of the phase of the antenna weighted value, as taught by Koga, in the Aoyama's device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 4**, the combination of Aoyama and Koga teach all the claimed elements in claim 3. In addition, Both of them also teach the apparatus, wherein the second variable amplifier comprises a first adjustable phase amplifier to adjust the phase of the received signal (See Aoyama, Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight") and to provide the real component of the antenna weighted value (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively); and a second adjustable phase amplifier to adjust the phase of the received signal (See Aoyama, Page 1, 0004:

Art Unit: 2684

Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight") and to provide the imaginary portion of the antenna weighted value (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively).

**Regarding claim 7**, Aoyama teaches all the claimed elements in claim 6, except for the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal.

However, in related art, Koga teaches the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal (Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to

real part and imaginary part respectively).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal, as taught by Koga, in the Aoyama's device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 8**, the combination of Aoyama and Koga teach all the claimed elements in claim 7. In addition, Both of them also teach the apparatus, wherein the second variable gain amplifier comprises a first adjustable phase amplifier to adjust the phase of the amplitude adjusted signal (See Aoyama, Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")) and to provide the real portion of the antenna weighted value to the received signal (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part

respectively); and a second adjustable phase amplifier to adjust the phase of the amplitude adjusted signal (See Aoyama, Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight") and to provide the imaginary portion of the antenna weighted value to the received signal (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively).

**Regarding claim 9, Aoyama teaches apparatus, wherein the first and second antenna weighted generators provided first and second antenna weighted received signals (Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight"). The array antenna radio communication apparatus may intensely receive only signals incoming from a desired direction by adjusting the multiplying weight), except for the apparatus further comprising: a first adder to combine first and second real components of the first and second antenna weighted received signals of the first and**

second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal; and a second adder to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal.

However, in related art, Koga teaches the apparatus further comprising: a first adder (Figure 1, element 15) to combine first and second real components of the first and second antenna weighted received signals of the first and second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal (Figure 1, adder 15 combine first and second real components of first and second antenna weighted received signal); and a second adder (Figure 1, element 15 also work as a second adder) to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal (Figure 1, adder 15 combine first and second imaginary components of first and second antenna weighted received signal). (Also, Col.3, line 62-Col. 4, line 2: Koga teaches a weight calculating section (WCS) 30 calculates the complex weight of each branch. A complex multiplying section (CMS) 100 multiplies the complex base band signal issued from each receiving circuit 2 by the complex weight of each branch generated in the WCS 30. A complex adder (CA) 15 adds the complex base band signal issued from the receiving circuit 2 of each branch after passing through the CMS 100).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the apparatus further comprising:

a first adder to combine first and second real components of the first and second antenna weighted received signals of the first and second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal; and a second adder to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal, as taught by Koga, in the Aoyama device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 10**, the combination of Aoyama and Koga teach all the claimed elements in claim 9. In addition, Koga teaches the apparatus comprises: a radio frequency to an intermediate frequency quadrature downconverter to provide an in-phase portion and a quadrature portion of an intermediate frequency signal (Col. 3, line 51-58: Koga teaches in FIG. 1, a receiving circuit 2 converts a receiving signal obtained in an antenna 1 in every branch into a complex base band signal. The receiving signal has been modulated in quadrature, and contains in-phase component and quadrature component. Herein, the complex base band signal is a signal composed of in-phase component and quadrature component corresponding to a real part and an imaginary part respectively).

**Regarding claim 13**, Aoyama teaches all the claimed elements in claim 12, except for the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal.

However, in related art, Koga teaches the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal (Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the apparatus, wherein the second variable amplifier is able to provide a real portion of the antenna weighted value and an imaginary portion of the antenna weighted value to the received signal, as taught by Koga, in the Aoyama's device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 14**, the combination of Aoyama and Koga teach all the claimed elements in claim 13. In addition, both of them also teach the apparatus, wherein the

Art Unit: 2684

second variable gain amplifier comprises a first adjustable phase amplifier to adjust the phase of the amplitude adjusted signal (See Aoyama, Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")) and to provide the real portion of the antenna weighted value to the received signal (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving signal correspond to real part and imaginary part respectively); and a second adjustable phase amplifier to adjust the phase of the amplitude adjusted signal (See Aoyama, Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight")) and to provide the imaginary portion of the antenna weighted value to the received signal (See Koga, Column 4, line 19-26: Koga teaches receiving a signal by the antenna 1, the received signal is passed through the high frequency circuit 21, band pass filter 22, AGC amplifier 23, and quadrature detector 25. In this period, a complex base band signal is obtained, in which the in-phase component and quadrature component of receiving

signal correspond to real part and imaginary part respectively).

**Regarding claim 15**, Aoyama teaches the apparatus, wherein the first and second antenna weighted generators provided first and second antenna weighted received signals (Page 1, 0004: Aoyama teaches the array antenna radio communication apparatus adjusts the amplitude and phase of the received signals by multiplying the received signals by a weight factor (hereinafter, called as "weight"). The array antenna radio communication apparatus may intensely receive only signals incoming from a desired direction by adjusting the multiplying weight), except for the apparatus further comprising: a first adder to combine first and second real components of the first and second antenna weighted received signals of the first and second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal; and a second adder to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal.

However, in related art, Koga teaches the apparatus further comprising: a first adder (Figure 1, element 15) to combine first and second real components of the first and second antenna weighted received signals of the first and second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal (Figure 1, adder 15 combine first and second real components of first and second antenna weighted received signal); and a second adder (Figure 1, element 15 also work as a second

Art Unit: 2684

adder) to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal (Figure 1, adder 15 combine first and second imaginary components of first and second antenna weighted received signal). (Also, Col.3, line 62-Col. 4, line 2: Koga teaches a weight calculating section (WCS) 30 calculates the complex weight of each branch. A complex multiplying section (CMS) 100 multiplies the complex base band signal issued from each receiving circuit 2 by the complex weight of each branch generated in the WCS 30. A complex adder (CA) 15 adds the complex base band signal issued from the receiving circuit 2 of each branch after passing through the CMS 100).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the apparatus further comprising:

a first adder to combine first and second real components of the first and second antenna weighted received signals of the first and second antenna weighted value generators, respectively, and to provide a real component of a radio frequency signal; and a second adder to combine first and second imaginary components of first and second antenna weighted received signals, respectively, and to provide an imaginary portion of the radio frequency signal, as taught by Koga, in the Aoyama device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 16**, the combination of Aoyama and Koga teach all the claimed elements in claim 15. In addition, Koga teaches the apparatus, comprises: a radio frequency to an intermediate frequency quadrature downconverter to provide an in-phase portion and a quadrature portion of an intermediate frequency signal (Col. 3, line 51-58: Koga teaches in FIG. 1, a receiving circuit 2 converts a receiving signal obtained in an antenna 1 in every branch into a complex base band signal. The receiving signal has been modulated in quadrature, and contains in-phase component and quadrature component. Herein, the complex base band signal is a signal composed of in-phase component and quadrature component corresponding to a real part and an imaginary part respectively).

**Regarding claim 19**, Aoyama teaches all the claimed elements in claim 17, except for the communication system, wherein the antenna receiver further comprises: a first adder to combine real portions of plurality of antenna weighted received signals and to provide a real portion of a radio frequency signal; and a second adder to combine plurality of imaginary portions of the plurality of antenna weighted received signals and to provide an imaginary portion of the radio frequency signal.

However, in related art, Koga teaches the communication system, wherein the antenna receiver further comprises: a first adder (Figure 1, element 15) to combine real portions of plurality of antenna weighted received signals and to provide a real portion of a radio frequency signal (Figure 1, adder 15 combine first and second real components of first and second antenna weighted

Art Unit: 2684

received signal); and a second adder (Figure 1, element 15 also work as a second adder) to combine plurality of imaginary portions of the plurality of antenna weighted received signals and to provide an imaginary portion of the radio frequency signal (Figure 1, adder 15 combine first and second imaginary components of first and second antenna weighted received signal). (Also, Col.3, line 62-Col. 4, line 2: Koga teaches a weight calculating section (WCS) 30 calculates the complex weight of each branch. A complex multiplying section (CMS) 100 multiplies the complex base band signal issued from each receiving circuit 2 by the complex weight of each branch generated in the WCS 30. A complex adder (CA) 15 adds the complex base band signal issued from the receiving circuit 2 of each branch after passing through the CMS 100).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the communication system, wherein the antenna receiver further comprises: a first adder to combine real portions of plurality of antenna weighted received signals and to provide a real portion of a radio frequency signal; and a second adder to combine plurality of imaginary portions of the plurality of antenna weighted received signals and to provide an imaginary portion of the radio frequency signal, as taught by Koga, in the Aoyama device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

**Regarding claim 20**, the combination of Aoyama and Koga teaches all the claimed elements in claim 19. In addition, Koga teaches the communication system, wherein the antenna receiver further comprises: a radio frequency to an intermediate frequency quadrature downconverter to provide an in-phase portion and a quadrature portion of an intermediate frequency signal (Col. 3, line 51-58: Koga teaches in FIG. 1, a receiving circuit 2 converts a receiving signal obtained in an antenna 1 in every branch into a complex base band signal. The receiving signal has been modulated in quadrature, and contains in-phase component and quadrature component. Herein, the complex base band signal is a signal composed of in-phase component and quadrature component corresponding to a real part and an imaginary part respectively).

**Regarding claim 21**, the combination of Aoyama and Koga teaches all the claimed elements in claim 20. In addition, Koga teaches the communication system, wherein the antenna receiver further comprises: an intermediate frequency to a base band frequency downconverter coupled to a radio frequency to an intermediate frequency downconverter to provide a real portion and an imaginary portion of a base band e frequency signal (Col.1, line 54-63 and Col. 3, line 50-58: Koga teaches in the adaptive array diversity receivers, for each diversity branch, there is a receiver circuit converting the receiving signals from the antenna into a base band signal which is not detected coherently. For the k-th branch ( $k=1, 2, \dots, K$ ), the base band

Art Unit: 2684

signal  $X_k$  is multiplied by a complex weight  $W_k$  and summed with the weighted base band signals from the other branches for combining. The  $W_k$  is calculated to adjust the phase and the amplitude of each branch in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output. In FIG. 1, a receiving circuit 2 converts a receiving signal obtained in an antenna 1 in every branch into a complex base band signal. The receiving signal has been modulated in quadrature, and contains in-phase component and quadrature component. Herein, the complex base band signal is a signal composed of in-phase component and quadrature component corresponding to a real part and an imaginary part respectively).

**Regarding claim 24,** Aoyama teaches all the claimed elements in claim 23 except for the method, further comprising downconverting the radio frequency signal to an intermediate frequency signal.

However, in related art, Koga teaches the method, further comprising downconverting the radio frequency signal to an intermediate frequency signal (Col. 1, line 54-57: Koga teaches in the adaptive array diversity receivers, for each diversity branch, there is a receiver circuit converting the receiving signals (radio frequency signal) from the antenna into a base band signal (intermediate frequency signal)).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the teaching of the method, further comprising

downconverting the radio frequency signal to an intermediate frequency signal, as taught by Koga, in the Aoyama's device in order to intensify the desired signal and to cancel or reduce the interference signal and noise at the combining output (Koga, Col.1, line 60-63).

### ***Conclusion***

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hladik et al. (US Patent #5,465,271) teaches post detection weighted vector combining diversity receivers using phase metrics for mobile and indoor radio channels.

Hayashi (GB 2340354 A) teaches CDMA receiver where the received signals are phase adjusted/time delayed and then summed before despreading.

Otsuka-cho (EP 1187365 A2) teaches OFDM receiving apparatus with antenna diversity.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dominic E. Rego whose telephone number is 571-272-8132. The examiner can normally be reached on Monday-Friday, 8:30 am-5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay Maung can be reached on 571-272-7882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2684

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Dominic E. Rego

EDAN ORGAD  
PATENT EXAMINER/TELECOMM.

11/26/11